

section deals with aberration; it is supposed that the ether in a moving body remains, so far as the motion of the body is concerned, at rest. Thus another term has to be added to the expression for the current; the ions are carried with the body, and give rise to a convection current.

This assumption appears, however, open to criticism. Since the total charge in any element of volume is zero, the total convection current due to the motion of that element, as a whole, must also be zero. The case differs from that in which the oppositely charged ions are set in motion in opposite directions by electric force. The fact that the axes to which we refer the relative motions of the ions are themselves in motion, introduces new terms into the equations which are sufficient to account for aberration without assuming the existence of this convection current.

The consequences of this relative motion are examined, following H. A. Lorentz, to whose labour on this subject so much of our knowledge is due, and an explanation given of aberration and of Fizeau's celebrated experiment on the effect of moving water on the velocity of light.

In all this work Prof. Drude has been most successful; the electromagnetic theory, supplemented by the one additional hypothesis of the moving ions, serves to co-ordinate in a satisfactory way very many of the phenomena of light.

Further knowledge may modify our views, but up to the present Prof. Drude's book contains the most rational account of the phenomena of optics which we possess; it is a book which should be read by all students, and he is to be congratulated on having written it.

And now having said this, in conclusion a grumble and a suggestion may be permitted. There is no index, and though the table of contents is a full one, this can never replace an index. Again, the book would be more interesting and more valuable, and would give a fairer account of the subject, if the references to original papers, especially papers published some time back and in other countries besides Germany, were more complete. A second edition will be called for before long. Will Prof. Drude increase the gratitude due to him for his work by remedying these two defects?

#### AGRICULTURAL EDUCATION IN THE UNITED STATES.

*Year-book of the United States Department of Agriculture, 1899.* Pp. 880; 63 plates. (Washington: Government Printing Office, 1900.)

THE present volume is a special one, the Secretary of Agriculture desiring "that the Year-book for 1899, the distribution of which will occur during the last year of this century, shall present to the reader a picture of the development of agriculture in the United States during the nineteenth century, and of its condition at the present time." The volume contains twenty-six reports, from the various bureaux and divisions under the Department of Agriculture. These reports are followed by an appendix giving particulars respecting the various agricultural organisations now at work in the country. The whole is copiously illustrated.

The various reports on the development of knowledge

and of work during the past century are of course written in a popular style, being primarily intended for the information of the general community in the United States; we must not, therefore, expect to find in them much exact science. They are, nevertheless, of great permanent value, and should be carefully studied by all those who desire that the agriculture and the agriculturist of Great Britain should exhibit the rapid progress in improvement which this volume shows to be taking place on the other side of the Atlantic.

As the subject of agricultural education is now occupying the public mind in England, it will perhaps be of service if we briefly mention what is at present being done in America, as set forth in the volume now before us.

The Report dealing with education informs us that the attempts to introduce instruction in agriculture into elementary rural schools have failed. Now, however, a hopeful movement has been started by the College of Agriculture at Cornell University, and taken up by some other State colleges, for the introduction of "nature studies" into elementary schools. To accomplish this object leaflets containing suitable matter for lessons have been issued, and model lessons are given in the schools by travelling inspectors. The first difficulty to be surmounted is, in fact, the teaching of the teachers. Up to the present time little has been done toward the establishment of second grade agricultural schools, and agricultural subjects are not as yet taught in the High Schools.

In America, the State College or University, with the Experiment Station attached to it, have been the prime movers in agricultural education. The colleges have by no means confined their work to their own students, but have actively carried on a large amount of external teaching of various kinds. Thus, besides the full course of instruction, lasting two or four years, provided for the members of the college, short winter courses of twelve weeks' instruction are in many cases provided for the special requirements of young farmers, and in some States these short courses have been very successful. The staff of the college and experiment stations also do much good by lecturing at farmers' institutes. These institutes will meet for a session of three days in various places, the time being occupied by a series of papers and discussions. It is estimated that about 2000 of these meetings were held in the United States during 1898, attended by half a million farmers. In Wisconsin the best papers are issued as an annual volume, 60,000 copies of which are distributed, one being placed in the library of every elementary school. The practical influence of these institutes has been very great. Several State colleges have also commenced correspondence classes in agriculture, and have enrolled a large number of readers who receive assistance and advice from the college. The influence of the experiment stations has also been very great; their investigations have produced a local interest in the study of agricultural problems, and afforded examples of the aid which science can render to the farmer. Without the work of the station the teaching of the college would have appeared academic and theoretical, and would have failed to commend itself to the practical man. The

farmer's bulletins issued by each experiment station, and distributed post-free throughout the State to every farmer asking to receive them, are of considerable educational value. The work of all the State colleges and experiment stations is unified by the Association of American Agricultural Colleges and Experiment Stations. This Association consists of delegates appointed by the colleges and stations, and by the United States Department of Agriculture, and meets for several days once a year to hear reports and discuss methods of work. The Association has permanent executive committees, which carry out the work initiated by the Association.

Although both colleges and experiment stations are State institutions, they are more or less under the influence of the National Department of Agriculture, as every institution receives annual grants from Government funds, for the proper use of which the Department of Agriculture is made responsible. The United States Department of Agriculture is on a very large scale; the sum appropriated to its use by Congress in 1899 was 2,829,702 dollars. It includes many sub-departments, provided with a numerous staff of scientific workers. It has excellent laboratories, a botanic garden, museum and library containing 68,000 volumes, three-quarters of which are on agricultural subjects. It undertakes investigations of all kinds. It publishes in the *Experiment Station Record* summaries of all the work done by the experiment stations. The publications it issues for gratuitous circulation are most voluminous, and embrace all subjects with which it is thought the farmer or student should be acquainted. In 1899, 26,420 pages were published, and 7,075,975 copies printed. Of the present year-book the edition is 500,000 copies, with 20,000 extra copies for the Paris Exhibition.

We have already mentioned the sum annually spent by Congress on the Department, we may conclude by saying that the annual income of the State agricultural and mechanical colleges is stated in the year-book to be 6,008,379 dollars, while the income of the experiment stations amounts to 1,143,334 dollars. Such is in brief the provision made in the United States for the improvement of the science and practice of agriculture in the country.

R. WARINGTON.

#### OUR BOOK SHELF.

*Lehrbuch der Anorganischen Chemie.* Von Dr. A. F. Holleman. In gemeinschaft mit dem Verfasser bearbeitet und herausgegeben von Dr. Wilhelm Manchot. Pp. xii + 440. (Liepzig: Veit and Co., 1900.)

THIS is an advanced text-book of inorganic chemistry, distinguished from others chiefly by the embodiment in it of chapters of modern physical chemistry. The book, indeed, gives the impression of having been produced by shuffling the detached chapters of two others—one, an ordinary treatise on inorganic chemistry, the second on physical chemistry.

It is almost impossible to discern the system which has guided the compilers. The book begins with some generalities about the scope of science, and the differences between physics and chemistry. It then proceeds to describe some chemical operations, such as dissolving, filtering and distilling. This is done in language suitable for children, and illustrated by two diagrams, in one of which a filter paper is seen to project considerably above the rim of the funnel. The elements having been named,

oxygen is next described—such terms as critical temperature being taken as understood by the reader, who has just been told how to separate salt from sand. After a description of hydrogen, the indestructibility of matter is discussed, and then comes water. The laws of chemical combination and the atomic theory occupy the next few pages, then chlorine and its compounds. We now come upon the laws of Gay Lussac and Avogadro, ozone and hydrogen peroxide, then modern methods of determining molecular weights, with a discussion of semi-permeable membranes. And so the book proceeds. Dissociation is discussed between iodine and fluorine, electrolytic dissociation between the halogens and sulphur, the phase rule under sulphur, thermochemistry, including thermodynamics between sulphur and nitrogen.

It is impossible to say anything in praise of this arrangement or want of arrangement. It can hardly be defended on logical or didactic grounds, and one is tempted to think that there is nothing more than a striving for novelty at the bottom of it.

The book does not aim at teaching how chemists do their work, discover facts, and establish theories; and surely if it were desired to present descriptive inorganic chemistry on the basis of the general theories of modern physical chemistry, it would have been better to have begun with an account of these theories and to have woven them into the descriptive part throughout.

Whilst speaking thus of the general scope of Prof. Holleman's book, it is right to add that in detail there are features that call for commendation. The descriptive part is well abreast of the times, and many of the intercalated chapters on physical chemistry are clearly and concisely written. A concluding chapter summarising Werner's voluminous papers on the metal-ammonium compounds is a valuable addition.

On the whole, it may be said that as a work of moderate dimensions conveying the chief facts of inorganic chemistry and an account of those physico-chemical theories which bear especially on inorganic chemistry, Prof. Holleman's book will probably find considerable acceptance in Germany, but it is neither to be expected nor desired that it will set a fashion in its plan of construction.

A. S.

*Flora of Bournemouth, including the Isle of Purbeck.* By E. F. Linton, M.A. With map. New edition. Pp. vii + 290. (Bournemouth: Sold by H. S. Commin, Bright's Stores, and W. Mate and Sons.)

THE local flora embodied in the pages of the book before us appears to be usefully compiled, though perhaps the volume as a whole would have been improved had it been printed on thinner paper, so as to form a more convenient pocket companion. Opening with a short introduction on the physical and geological characters of the district, the author gives a list of some 1137 plants (flowering plants and ferns) as occurring within the area treated of, and adds localities, as is usual in works of this nature. The book should prove useful to those lovers of wild flowers who are visiting the Bournemouth district, to many of whom it may perhaps be a matter of surprise that so large a percentage of the British flora occurs within a twelve-mile radius from the town.

*Carnations and Picotees for Garden and Exhibition.* By H. W. Weguelin, F.R.H.S. Pp. viii + 125. (London: George Newnes, Ltd., 1900.)

THIS is a book which will be useful to those who are fond of carnations. The cultural hints are clear, and lists are given of many of the best sorts. The text is a little diffuse in places, but in a work of this character that is a pardonable characteristic. The author is enthusiastic on his subject, and his book is worth reading, if only to show what can be done with the flowers as materials for open borders.